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## Research productivity on COVID-19: A Bibliometric approach

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### Abstract

The study aimed to explore the perspective of COVID-19 publications across the globe. Further, attempts were also made to find out the most productive country, author, and institute in publishing literature on COVID-19. The data related study was retrieved from SCOPUS database. Various search strategies were used to retrieve publications on COVID-19 published between 1<sup>st</sup> December 2019 and 22<sup>nd</sup> June 2020. A total of 19,991 publications on COVID-19 were retrieved from the Scopus database.

Further, it was found that Huazhong University of Science and Technology, China has produced 422 publications and received 5624 citations with an average citation of 13.327 per publication. BMJ Clinical Research Ed published 534 (1.61%) articles. Among the most productive authors, Wiwanitkit, Viroj from Hainan Medical University, China stands in the first place with 73 publications followed by Mahase, E. from the British Medical Journal, UK (52 publications) and Iacobucci, Gareth (48 publications). The study provided a relatively objective reference for peer scientists, national regimes, and the global health system. The findings of the study will definitely help the institutions as well as authors to get an opportunity to collaborate with regional, national and international research institutions and scientists.

**Keywords:** COVID-19; Coronavirus; Pandemic diseases, Bibliometric study

### Introduction

In December, 2019, Wuhan, Hubei city in China, became the center of an outbreak of pneumonia of anonymous cause. Chinese health authorities did an immediate investigation to characterise and control the disease, including isolation of people suspected to have the disease. Though the outbreak of COVID-19, SARS-CoV-2 occurred in China first, it rapidly spread globally. CoVs are a large family of viruses that cause respiratory illness. CoV is related to Severe Acute

Respiratory Syndrome Coronavirus (SARSCoV) (Chan and Chan 2013; Wevers and van der Hoek 2009). As on 24th June 2020 there are 9,129,146 COVID-19 positive cases and 473,797 deaths confirmed in globally (WHO, Situation Report-156). The coronavirus disease pandemic puts unprecedented pressures on healthcare systems worldwide. As COVID-19 spreads rapidly, the research community has been active in publishing literature in various journals on this dreadful disease.

In this context, this study made an attempt to explore the literature published on this disease. Further, an attempt has been made to know the most productive country, institute and authors based on number of articles.

### **Review of Literature**

In the recent years, bibliometric analysis has become popular, which helps to predict the detailed trends of research or hotspots in a certain field. Bibliometric methods aid in measurement of the publication pattern on a given topic, journals, authors, institutions, and countries using statistical methods (Broadus 1987; Garfield, Malin, and Small 1978; Glänzel 2003). The review of literature shows that there have been few bibliometric studies on COVID-19, mainly focusing on SARS, MERS, and there is a lack of comprehensive analysis and research hotspot prediction for this disease. Studies on SARS have been reported (Chiu, Huang, and Ho 2004) in terms of highly cited articles (Kostoff 2010) and geographic area-specific research output on infectious disease (Wang et al. 2016; Zyoud 2016) but there are very few studies (Shri Ram 2020; Chahrour M, Assi S, Bejjani M, et al 2020) on detailed bibliometric analyses on COVID-19. Keeping in view this research gap, in this study attempt were made to explore on various facets of bibliometric on COVID-19.

### **Objectives of study**

The study has been conducted with the following objectives:

- a) To know the most productive author(s), institution and county based on number of publications
- b) To identify the different form of publications published on COVID-19 research
- c) To explore different founding agencies assisting to conduct research on COVID-19

- d) To know the most productive journals in publishing COVID-19 research

### **Methodology**

The SCOPUS database was used to retrieve bibliographic data. SCOPUS is one of the most comprehensive peer-reviewed journal databases in the world and it can provide good scientific academic information (Klapka & Slaby, 2018). The search strategy was limited to publications between 1<sup>st</sup> December 2019 and 22<sup>nd</sup> June 2020. The following search strategy was used for searching the literature: (TITLE-ABS-KEY("COVID") OR TITLE-ABS-KEY("coronavirus 2019") OR TITLE-ABS-KEY("COVID 2019") OR TITLE-ABS-KEY("COVID 19") OR TITLE-ABS-KEY("novel coronavirus 2019") OR TITLE-ABS-KEY("SARS nCoV") OR TITLE-ABS-KEY("SARS-CoV-2") OR TITLE-ABS-KEY("2019-nCoV") OR TITLE-ABS-KEY("Corona virus disease 2019") AND (LIMIT-TO (PUBYEAR, 2020) OR LIMIT-TO (PUBYEAR, 2019)). No restrictions on languages or publication types were applied due to the smaller number of publications on this recent topic.

### **Data Analysis and Interpretation**

The most productive authors published research papers on COVID 19 is shown in table 1. Of the 159 authors, Wiwanitkit, Viroj from Hainan Medical University, China stands in the first place (73 publications) followed by Mahase, E. from the British Medical Journal, UK (52 publications) and Iacobucci, Gareth (48 publications). These three authors have made great contribution and become authorities in COVID-19 research. With respect to the number of citations received by the authors, Drosten, Christian has published 19 publications and received 1691 citations. Hsueh, Po-Ren, from National Taiwan University Hospital, However, Taiwan has published 21 publications but received less number of citations (402 citations.) in comparison with Drosten, Christian.

Table 2 shows the research productivity of different institution across the globe with respect to the COVID-19 literature. Of the top 10 institution, Huazhong University of Science and Technology, China has published 422 publications and received 5,624 citations which stand first in the ranked list. Tongji Medical College, China is in the second place with 417 Publications and 5,500 citations) which is followed by Harvard Medical School, United States with 346 publications and 1,272 citations.

**Table 1. Most productive authors based on number of publications**

Author	Affiliation	Country	No of Publications	Number of citations	Average number of citations	Rank
Wiwanitkit, Viroj	Hainan Medical University	China	73	101	1.384	1
Mahase, E.	British Medical Journal	United Kingdom	52	127	2.442	2
Iacobucci, Gareth	British Medical Journal	United Kingdom	48	50	1.042	3
Lippi, G.	Università degli Studi di Verona	Italy	38	340	8.947	4
Joob, Beuy	Sanitation 1 Medical Academic Center	Thailand	30	75	2.500	5
Rodríguez-Morales, A. J.	Universidad Tecnológica de Pereira	Colombia	29	190	6.552	6
Fabbrocini, Gabriella	Università degli Studi di Napoli Federico II	Italy	24	26	1.083	7
Goldust, Mohamad	Universitätsspital Basel,	Switzerland	24	17	0.708	7
Hsueh, Po-Ren	National Taiwan University Hospital	Taiwan	21	402	19.143	8
Lotti, Torello Maria	Università degli Studi di Roma La Sapienza,	Italy	20	21	1.050	9
Rimmer, Abi	British Medical Journal	United Kingdom	20	14	0.700	9
Sahu, Kamal Kant	Saint Vincent Hospital Worcester	United States	20	17	0.850	9
Wise, Jacqui	British Medical Journal	United Kingdom	20	02	0.100	9
Zumla, A.	University College London	United Kingdom	20	359	17.950	9
Drosten, Christian	Charité – Universitätsmedizin Berlin	Germany	19	1691	89.000	10

Note: Sorted by publication count

**Table 2. Most productive institutions in publishing literature on COVID-19**

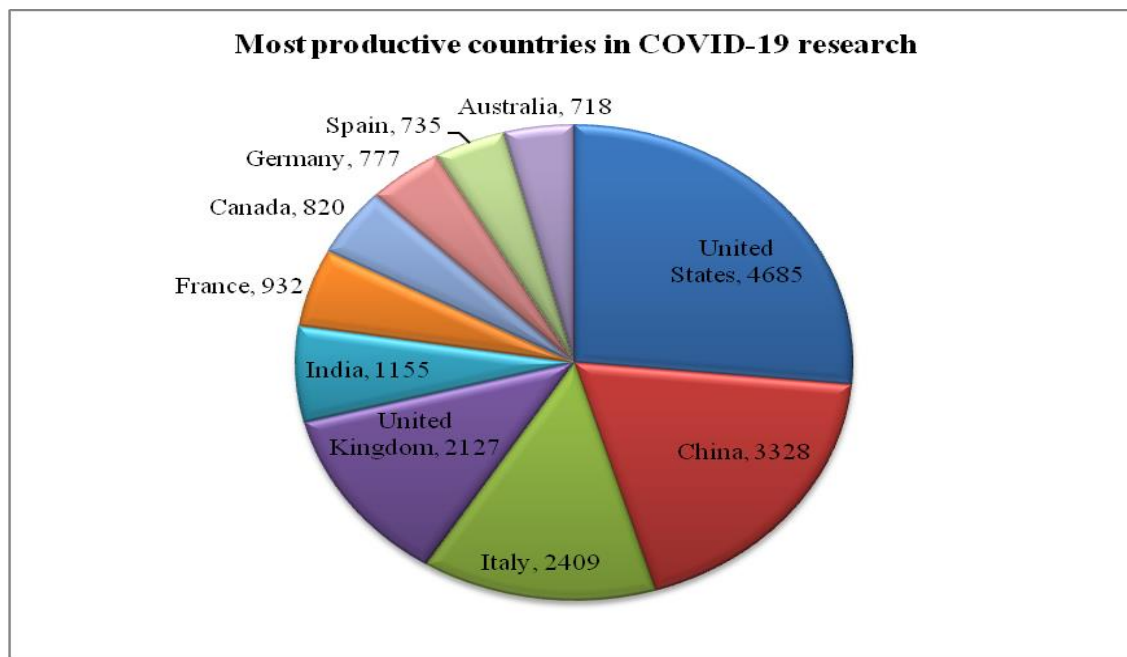
<b>Institution</b>	<b>Country</b>	<b>No of Publications</b>	<b>Percentage</b>	<b>Number of citations</b>	<b>Average number of citations</b>	<b>Rank</b>
Huazhong University of Science and Technology	China	422	2.111	5,624	13.327	1
Tongji Medical College	China	417	2.086	5,500	13.189	2
Harvard Medical School	United States	346	1.731	1,272	3.676	3
Institut National De La Santé Et De La Recherche Médicale	France	287	1.436	964	3.359	4
Università degli Studi di Milano	Italy	262	1.311	1,104	4.214	5
University College London	United Kingdom	246	1.231	1,626	6.610	6
Università degli Studi di Roma La Sapienza	Italy	236	1.181	514	2.178	7
IRCCS Foundation Rome	Italy	227	1.136	843	3.714	8
University of Toronto	Canada	212	1.060	1,190	5.613	9
University of Oxford	United Kingdom	211	1.055	1,428	6.768	10

Note: Sorted by publication count

A total of 19,991 publications were published on COVID-19 research between 2019 and 2020. The United States of America (USA) has a lion share in publishing more number of research papers on COVID-19 (4685). The second country which has produced more number of literature is China (3,328) followed by Italy (2,409), United Kingdom (2127) and India (1155) (Table 3, Fiture-1). In has been noticed that in these countries more number of COVID-19 positive are found.

**Table 3. Most productive countries in COVID-19 research**

Country	No of Publications	Percentage	Rank
United States	4685	23.436	1
China	3328	16.647	2
Italy	2409	12.050	3
United Kingdom	2127	10.640	4
India	1155	5.778	5
France	932	4.662	6
Canada	820	4.102	7
Germany	777	3.887	8
Spain	735	3.677	9
Australia	718	3.592	10

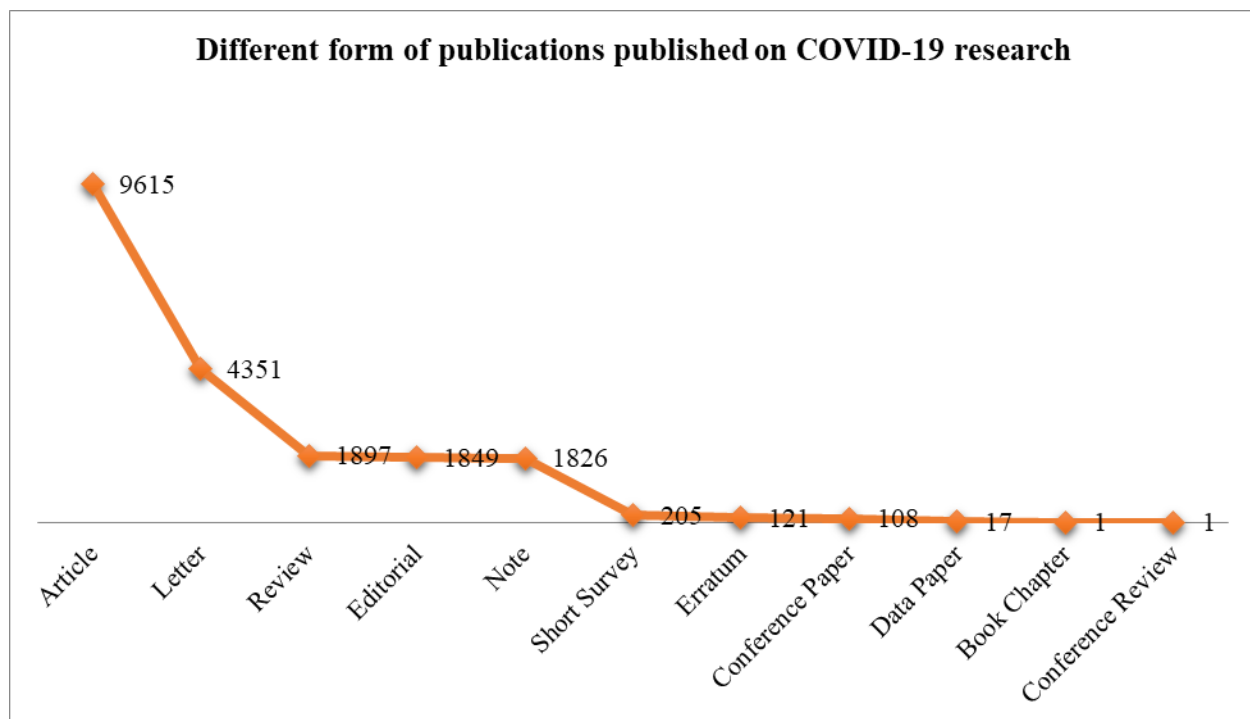


**Figure 1. Most productive countries in COVID-19 research.**

(Table 4) Of the 19,991 research papers, most of the literature was published in the form of research articles (9,615) and letters (4,351). It is also found that the literature also published in form of reviews (1,897) and editorial (1,847). Figure-2. Very less number of literatures was published in the form of book chapter and conference proceeding (each 0.005%).

**Table 4. Different form of publications published on COVID-19 research**

Document Type	No of Publications	Percentage
Article	9615	48.097
Letter	4351	21.765
Review	1897	9.489
Editorial	1849	9.249
Note	1826	9.134
Short Survey	205	1.025
Erratum	121	0.605
Conference Paper	108	0.540
Data Paper	17	0.085
Book Chapter	1	0.005
Conference Review	1	0.005



**Figure 2. Different form of publications published on COVID-19 research**

The distribution of COVID-19 literature by subject is indicated in table 5 as it evident from the table that most of literature has been published in Medicine (80.55%). Apart from that the



literature has also been published in Biochemistry, Genetics and Molecular Biology (9.61%) and Immunology and Microbiology (8.04%). It is very interesting to note that few articles are also published in Social Sciences (6.04%) and Nursing (3.832%).

**Table 5. Distribution COVID-19 research literature by subject**

Subject Area	No of Publications	Percentage
Medicine	16104	80.556
Biochemistry, Genetics and Molecular Biology	1923	9.619
Immunology and Microbiology	1608	8.044
Social Sciences	1208	6.043
Nursing	766	3.832
Neuroscience	698	3.492
Pharmacology, Toxicology and Pharmaceutics	694	3.472
Environmental Science	566	2.831
Psychology	478	2.391
Engineering	407	2.036
Health Professions	394	1.971
Arts and Humanities	307	1.536
Multidisciplinary	294	1.471
Computer Science	289	1.446
Agricultural and Biological Sciences	281	1.406
Business, Management and Accounting	270	1.351
Dentistry	210	1.050
Chemical Engineering	192	0.960
Mathematics	171	0.855
Economics, Econometrics and Finance	151	0.755
Chemistry	146	0.730
Energy	138	0.690
Physics and Astronomy	138	0.690
Veterinary	110	0.550
Materials Science	90	0.450
Earth and Planetary Sciences	50	0.250
Decision Sciences	39	0.195
Undefined	52	0.260

The National Natural Science Foundation of China has funded to publish 516 (2.581%) articles on COVID-19. (Table 6, Figure-3) Further, National Institutes of Health has funded to publish 237 (1.186%) articles followed by National Basic Research Program of China and the Wellcome Trust, (Each 80 articles; 0.40%).

**Table 6. Different founding agencies assisting to conduct research on COVID-19**

Founding agency	No of Publication	Percentage
National Natural Science Foundation of China	516	2.581
National Institutes of Health	237	1.186
National Basic Research Program of China	80	0.400
Wellcome Trust	80	0.400
National Institute for Health Research	76	0.380
National Institute of Allergy and Infectious Diseases	76	0.380
Fundamental Research Funds for the Central Universities	55	0.275
National Science Foundation	52	0.260
Bill and Melinda Gates Foundation	51	0.255
Pfizer	51	0.255

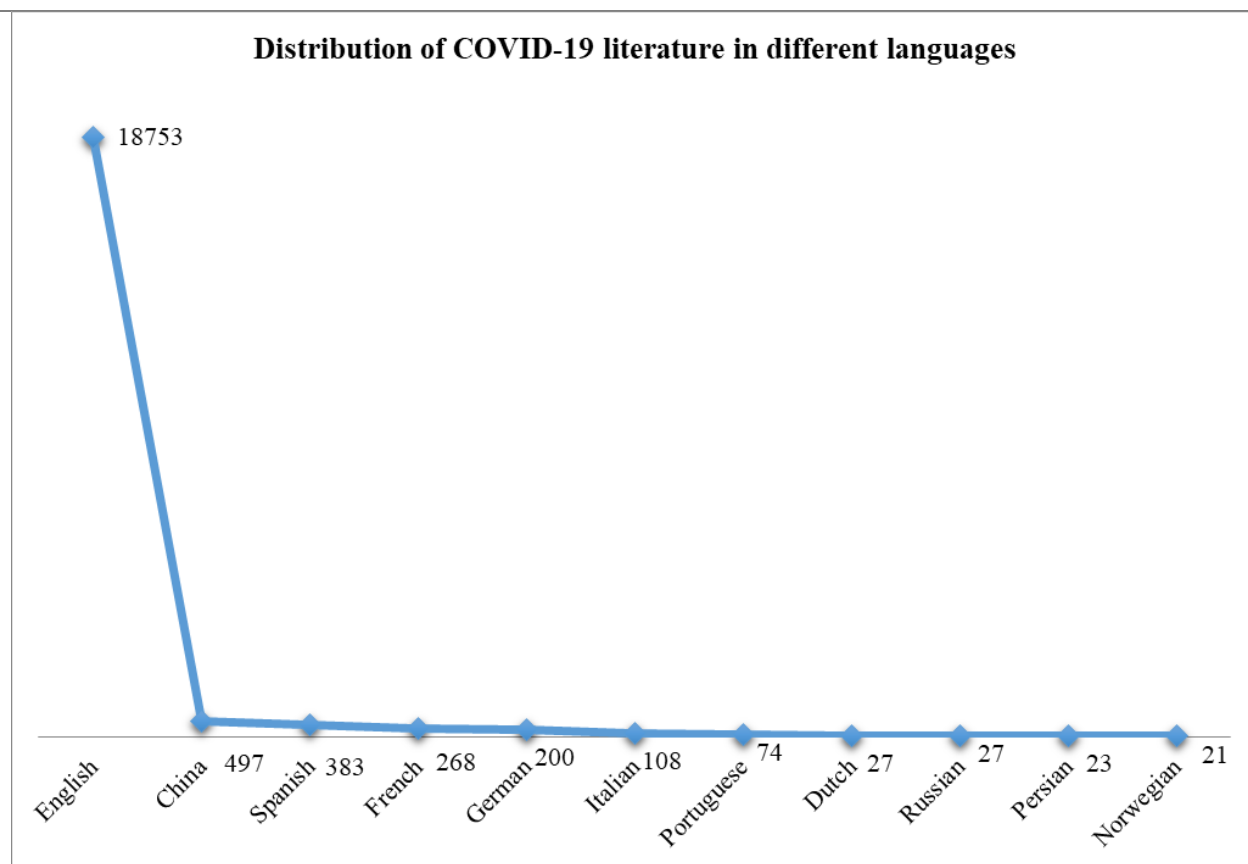


**Figure 3. Different founding agencies assisting to conduct research on COVID-19**

Table 7 and Figure-4 shows that out of 19,991 publications on coronavirus research, 18,753 (93.807%) publications are published in English. It is worthy to note that 497 (2.486%) articles are published in Chinese language followed by Spanish, 383 (1.916%) and French, 268 (1.341%).

**Table 7. Distribution of COVID-19 literature in different languages**

Language	No of Publications	Percentage
English	18753	93.807
China	497	2.486
Spanish	383	1.916
French	268	1.341
German	200	1.000
Italian	108	0.540
Portuguese	74	0.370
Dutch	27	0.135
Russian	27	0.135
Persian	23	0.115
Norwegian	21	0.105



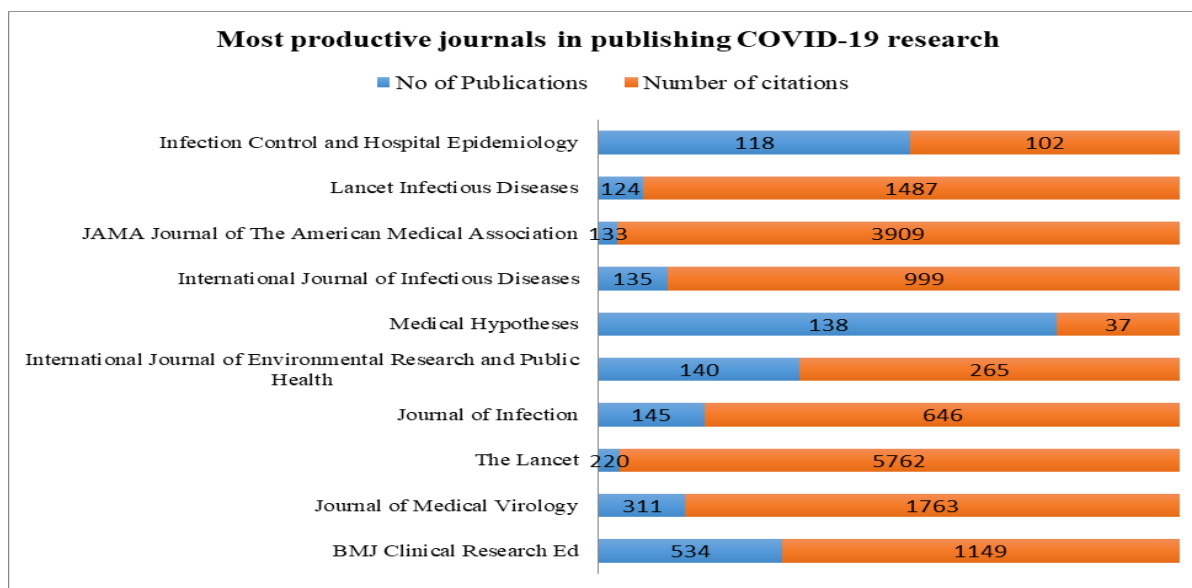
**Figure 4. Distribution of COVID-19 literature in different languages**

Figure-5. Between 2019 to 2020, a total of 19,991 articles were published on COVID-19 in different journals (Table 8). It can be seen from the table that BMJ Clinical Research Ed published highest number of articles (534) and stands in first place. The next highest numbers of articles are published in Journal of Medical Virology (311) followed by The Lancet (220).

**Table 8. Most productive journals in publishing COVID-19 research**

Journal	No of Publication	Percentage	Number of citations	Rank
BMJ Clinical Research Ed	534	1.611	1149	1
Journal of Medical Virology	311	1.556	1763	2
The Lancet	220	1.100	5762	3
Journal of Infection	145	0.725	646	4
International Journal of Environmental Research and Public Health	140	0.700	265	5
Medical Hypotheses	138	0.690	37	6
International Journal of Infectious Diseases	135	0.675	999	7
JAMA Journal of The American Medical Association	133	0.665	3909	8
Lancet Infectious Diseases	124	0.620	1487	9
Infection Control and Hospital Epidemiology	118	0.590	102	10

Note: Sorted by publication count

**Figure 5. Most productive journals in publishing COVID-19 research**

### Most cited papers in COVID-19 literature

The study also made an attempt identify the most cited in paper in COVID-19 literature. It can be seen from the table 9 that The 10 that *Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China* by Huang, C et al., published in the Lancet Journal, was cited in 1568 articles followed by *Clinical Characteristics of 138 Hospitalized Patients with 2019 Novel*

*Coronavirus-Infected Pneumonia in Wuhan, China* by Wang, D et al., published in JAMA - Journal of the American Medical Association (1568 citations).

**Table 9. Most cited papers in COVID-19 literature**

<b>Authors</b>	<b>Title</b>	<b>Journal</b>	<b>Cited by</b>	<b>Rank</b>
Huang, C., et al.	Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China	The Lancet	2655	1
Wang, D., et al.	Clinical Characteristics of 138 Hospitalized Patients with 2019 Novel Coronavirus-Infected Pneumonia in Wuhan, China	JAMA - Journal of the American Medical Association	1568	2
Guan, W., et al.	Clinical characteristics of coronavirus disease 2019 in China	New England Journal of Medicine	1547	3
Zhu, N., et al.	A novel coronavirus from patients with pneumonia in China, 2019	New England Journal of Medicine	1455	4
Chen, N., et al.	Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study	The Lancet	1375	5
Zhou, F., et al.	Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study	The Lancet	1050	6
Zhou, P., et al.	A pneumonia outbreak associated with a new coronavirus of probable bat origin	Nature	975	7
Chan, J.F.-et al.	A familial cluster of pneumonia associated with the 2019 novel coronavirus indicating person-to-person transmission: a study of a family cluster	The Lancet	832	8
Lu, R., et al.	Genomic characterisation and epidemiology of 2019 novel coronavirus: implications for virus origins and receptor binding	The Lancet	755	9
Holshue, M.L., et al.	First case of 2019 novel coronavirus in the United States	New England Journal of Medicine	608	10

Note: Sorted by publication count

## **Conclusion and Discussion**

The outbreak of COVID-19 has caused a major threat to the international community and has raised significant public health concerns (Chahrour, M 2020). Within the span of seven months more than 19,991 publications on COVID-19 coronavirus were published in various journals across the globe.. It is found that Wiwanitkit, Viroj from Hainan Medical University published highest number of research article on COVID-19. Further, Huazhong University of Science and Technology, China has produced more (n=422) of publications also received 5624 citations. The USA has he lion share in publishing research papers on COVID-19 (23.43%) by China (16.64%) and Italy (12.05%). The most published documents on COVID-19 were open access and were published in prestigious journals with high impact factor viz., BMJ Clinical Research Ed, Journal of Medical Virology and Lancet.

Most of the founding agencies have sponsored funds for conducting research on COVID-19. National Natural Science Foundation of China, National Institutes of Health under these both founding agencies have assisted to publish more than 200 publications.

However, there is a need to come out the vaccine to this pandemic disease. Scientists around the world are working on potential treatments and vaccines for the new coronavirus disease known as COVID-19. Several companies are also working on antiviral drugs, some of which are already in use against other illnesses, to treat people who already have COVID-19. Other companies are working on vaccines that could be used as a preventive measure against the disease. With confirmed COVID-19 cases worldwide surpassing more than 9 million and continuing to grow, scientists are pushing forward with efforts to develop vaccines and treatments to slow the pandemic and lessen the disease's damage.

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